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# DRAFT
# Characterization Analysis Report
# Surface Vessel Bilgewater/Oil Water Separator

Section 9.0 – MCM 1 Class: Vessels with Mine Countermeasure Compression Engines

August 2003

# SECTION 9.0 – MCM 1 CLASS

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# 9.0 MCM 1 CLASS

The Navy's Avenger Class mine countermeasure vessel (MCM 1) was selected to represent the group of operational surface vessels that are medium-sized (400 ≤ displacement < 6000 tons) that rely on compression engines for main propulsion. The MCM 1 Vessel class was chosen as the representative vessel class for this group because the MCM 1 Class is the Navy's latest class of mine countermeasure vessels. Additionally, with 14 vessels, the MCM is second-largest class in the group. This group consists of medium sized ships of the Navy, MSC, Coast Guard, and Army. This includes salvage ships, mine countermeasures, buoy tenders, research and surveillance ships, surveying ships, ocean tugs, and logistic support ships. Vessels in this group range in length from 128 ft to 522 ft, and operate in both coastal and ocean waters outside 12 nm from shore. This chapter presents the physical parameters, chemical data, field data, descriptive information, and generation rates for the MCM 1 Class vessels.

The primary bilge oil water separator (OWS) system currently installed onboard MCM 1 Class vessels is one 3-gpm gravity coalescence type oil-water separators. Additionally, MCM 1 Class vessels use one of two 16-gpm oily waste transfer pumps to offload oily waste and the same pumps to offload waste oil to shore facilities. Cross-connected piping allows either pump to serve the transfer and offload functions. These vessels typically process bilgewater both pierside and underway, discharging the processed effluent into the surrounding waters. The subsequent characterization analyses are based on a 3-gpm system processing the entire volume of bilgewater.

The following summarizes the general vessel characteristics for the MCM 1 Class vessels.

<u>General Vessel Characteristics (Navy, 2002)</u>

| | |
|---|---|
| Draft (ft): | 12 |
| Length at waterline (ft): | 217 |
| Beam at waterline (ft): | 44 |
| Displacement (tons): | 1367 |

## 9.1 BASELINE DISCHARGE

The baseline discharge is defined as the direct discharge of bilgewater, collected in the OWHT. This discharge is assumed to occur at the normal OWS flow rate while bypassing the OWS. It is important to note that although the term baseline discharge is used for this report, the Armed Forces vessels do not discharge bilgewater from the OWHT directly overboard without treatment. This scenario is included in the Uniform National Discharge Standards (UNDS) analysis only to establish a reference point for subsequent comparisons. The baseline analysis will be based on discharging the entire volume of untreated bilgewater overboard at 3 gpm.

### 9.1.1 Characterization Data

Sources of bilgewater aboard the MCM 1 Class vessels include liquid that drains from the interior spaces and upper decks into the bilge or lowest inner part of the vessel's hull (Navy, 2001a). Sources of bilgewater can be found in the main engine rooms, auxiliary machinery rooms, shaft alley, steering gear rooms, pump rooms, air conditioning and refrigeration machinery rooms, and oil laboratories. The liquid phase of this fluid may contain oily constituents including DFM (emergency diesel generators), JP-5 fuel (main gas turbine engines and aircraft), 2190TEP lube oil (auxiliary equipment), 9250 lube oil (emergency diesel generators), synthetic lube oil (main engines and aircraft engines), hydraulic oil (elevators, cranes, and winches), and various grades of grease lubricants used on pulleys, cables, valves, and other components which may have dripped directly into the bilge spaces, or other ship spaces communicating with the bilge. Other potential bilge constituents include dissolved metals and metal-containing particulate matter

#### *9.1.1.1 Physical Parameters*

The physical parameters presented in this section include values necessary for hydrodynamic modeling of the discharge, which differs from shipboard data. The characteristics of the MCM 1 baseline discharge (Table 9-1) were developed using the assumption that bilgewater is discharged overboard at the OWS design flow rate(s) while bypassing the OWS.

**Table 9-1. Discharge Characteristics for MCM 1 Baseline**

| Modeling Parameters | Values |
|---|---|
| Option Group | Baseline |
| Vertical (feet) | +2 |
| Transverse (feet) | -22 |
| Length (feet) | 210 |
| Diameter (inches) | 1.5 |
| Temperature (°C) | 25 |
| Salinity (ppt) | 8.0 |
| Flow (gpm) | 3 |
| Velocity (ft/sec) | 0.55 |
| Duration of Release Event (hr) | 2.05 |
| Time Between Release Events (hr) | 86.45 |

Vertical – Approximate distance from waterline to discharge port (+, above, -, below)
Transverse – Distance from centerline to discharge port (+, port, -, starboard)
Length – Approximate distance from forward perpendicular to discharge port
Diameter – Diameter of discharge port
ppt – parts per thousand
gpm – gallons per minute
ft/sec – feet per second
hr – hour
°C – Degree Celsius

The influent of the OWS is characterized in this report as the baseline from which a relative analysis of the marine pollution control device (MPCD) options can be performed. The parameters for the engineering and modeling recommendation summary are based on the specifications in MCM 1 installation drawings of the OWS and a ship check.

Several parameters were identified for the discharge port on the MCM 1. These parameters include: discharge port location in relation to the waterline (vertical), distance from the centerline to discharge port (transverse), approximate distance from forward perpendicular to discharge port (length), and discharge port diameter (diameter) (Navy, 1991). Additional discharge characteristics identified for modeling purposes include temperature, salinity, flow rate, discharge velocity, duration of release event, and time between release events.

The temperature of bilgewater is dependent on several factors. Bilgewater on a MCM 1 Class vessel is temporarily held in the ship's bilge or in an OWHT. Consequently, ambient air temperature inside the machinery space and the temperature of the source bilgewater can have an effect on bilgewater temperature. However, because the bilge and OWHT are separated from the water body only by the ship's hull, bilgewater is often at or near the ambient water temperature. Because bilgewater is not used as a cooling or heating fluid and there is ample opportunity for thermal equilibration (heat transfer through the metal hull), bilgewater is assumed to be at the temperature of the receiving water. Further, for modeling purposes, the ambient water temperature is assumed to be 25º C.

Unlike other parameters used for modeling purposes, sampling data from the LSD 47 and LSD 51 OWS influent was used to determine the salinity value for MCM 1 baseline discharge. To facilitate obtaining a representative salinity value, an average of the sample results were used to determine one representative salinity value for the baseline discharge (the same value is used for subsequent analysis of the primary treatment MPCD; see Section 9.2.1.1).

Of the remaining discharge characteristics required for modeling, flow, velocity, and duration of release event are interdependent. The exit velocity of the discharge port is equal to flow rate divided by the cross-sectional area of the discharge pipe (velocity = flow/area). The flow rate for the baseline is the rated capacity of the MPCD (i.e., 3 gpm for the gravity coalescer). The area is calculated from the diameter of the discharge pipe. The duration of the release event is based on the size of the OWT, the rated capacity of any control in place, and the bilgewater generation rate. It is assumed processing begins when the OWT reaches 90 percent capacity (Smith, B., 2001). The duration is calculated as follows:

Duration of Release = (0.90 * OWHT Volume) / (Rated MPCD Capacity – Bilgewater Generation Rate)

The time between release events is determined using bilgewater generation rate data and OWHT capacities. Again, for purposes of modeling, it is assumed that the entire discharge release/non-release cycle (a release event followed by the time between release events) occurs while the vessel is pierside. The formulas used to determine some of the values in the physical parameters section are presented in Appendix A.

#### *9.1.1.2 Constituent Data, Classical Data, and Other Descriptors*

#### *Chemical Data*

During UNDS Phase II, sampling was conducted aboard two vessels of the LSD 41 Class, USS OAK HILL (16-17 November 1999), and USS RUSHMORE (26 September 2000, 17 October

2000, 17 November 2000, 13 December 2000). These two sampling episodes serve as the primary sources of chemical data for this vessel group.

The samples were analyzed by Ecology and Environment, Inc., Pacific Analytical, Inc., Columbia Analytical Services (through Pacific Analytical, Inc.) and Q Biochem (formally ETS Analytical Services, Inc.). The results were reviewed by EPA and DoD to determine the quality of the analytical data. Some sample data were excluded in the final calculations, as documented in the *Draft Sampling Episode Report-USS RUSHMORE* (Navy, 2001e) and *Draft Sampling Episode Report – USS OAKHILL* (Navy, 2000f), based upon Sample Control Center (SCC) review. Data quality was considered for all analyses conducted. To ensure data quality after reviewing documented matrix spike failures, and process information discrepancies, a confirmation analysis was conducted for pesticides. This confirmation analysis revealed that there were no pesticides present in the reanalyzed samples. As a result, pesticides are not included in bilgewater discharge profiles (Navy and EPA, 2002).

SCC validated data include the constituents present in the waste stream and their concentrations. Sampling was conducted on the OWS influent, which was considered the untreated baseline for this vessel group. Several methods used for analyses during Phase I are different than those used for Phase II analyses. For example, mercury was analyzed by EPA Method 1631 for Phase I, but for Phase II samples, EPA Method 1620 was used. The primary difference between these methods is that Method 1631 has a much lower detection limit than Method 1620. The decision to use Method 1620 in place of Method 1631 was due to the susceptibility of Method 1631 to a variety of matrix interferences stemming from liquids released from machinery room equipment. After reviewing Phase I analytical data, EPA Method 1620, with the higher detection level, was found to be sufficient for Phase II because constituents were found in sufficiently high concentrations that the cost of using more sensitive and expensive techniques was unjustified. The sampling and analytical decisions made for samples collected on LSD 47 are detailed in the Sampling and Analysis Plan (SAP). Four field samples were taken during each sampling episode from the influent (representing the baseline) to the OWS. For more information, see the *Sampling Episode Report – USS RUSHMORE* (Navy, 2001e) and *Sampling Episode Report – USS OAK HILL* (Navy, 2000f).

Constituent concentrations are represented by the geometric mean of the measured concentrations in the influent samples. See Appendix H for final constituent values.

### *Field Information*

Field information refers to data obtained at the time of sample collection. Due to similarities in machinery, propulsion systems, and ancillary equipment, the LSD 41 vessel group discharge information is used to represent the MCM 1 vessel group. Consequently, the LSD 41 field data presented in Table 9-2 are surrogate values for the MCM 1 vessel group.

**Table 9-2. Surrogate Field Testing Parameters for MCM 1 Baseline (Based on LSD 41 Baseline Sampling Data)**

| Field Parameter | Values |
|---|---|
| pH | 7.1 |
| Temperature | 20 ºC |
| Salinity | 8.0 ppt |
| Specific Conductance | 14,000 µS/cm |
| Free Chlorine | 0.03 mg/L |
| Total Chlorine | 0.04 mg/L |

### *Descriptive Information*

Descriptive information refers to data collected to facilitate the environmental effects analysis. Due to similarities in machinery, propulsion systems, and ancillary equipment, the LSD 41 vessel group discharge information is used to represent the MCM 1 vessel group. Consequently, the LSD 41 vessel group data presented in Table 9-3 are surrogate data for characterization of the MCM 1 vessel group. For the parameters where the results were based on observation, the range of descriptive records provide the determinations. Specifically, color and odor determinations were made using these samples. For the parameters where the results were based on field tests, an average was used as the parameter value, except for the total dissolved gases parameter. For this parameter, the lowest dissolved oxygen (DO) value was reported in the profile report and used in the environmental effects analysis, because low DO is of greater environmental concern.

**Table 9-3. Surrogate Descriptive Discharge Profile for MCM 1 Baseline (Based on LSD 41 Baseline Sampling Data)**

| Narrative Parameter | Field Observations |
|---|---|
| Color | Yellow, 66 Color Units |
| Floating Materials | Not observed in most samples collected |
| Foam | None observed in samples collected |
| Odor | Oil/ fuel smell |
| Scum | None observed in samples collected |
| Settleable Materials | None observed in samples collected |
| Total Dissolved Gases | DO 1.90 mg/L, no other gases were measured |
| Turbidity/Colloidal Matter | 34 NTU/ No |

### *9.1.1.3 Discharge Generation Rates for Mass Loading*

MCM Class vessels are stationed in saltwater and freshwater ports. Daily generation rates were obtained from previously reported underway surveys (Navy, 1997a and 1995), which assume that in port generation rates are approximately 25 percent of the underway generation rates. The annual discharge volumes are derived in Table 9-4 by multiplying these reported values by the average number of days that the class spends in port or at sea in saltwater.

**Table 9-4. MCM 1 Generation Volumes for Vessels Operating in Saltwater**

| Class[1] | Number of Vessels | Days in Port[2] | Days Underway (0-12 nm) | Days Underway (12+ nm) | Daily generation rate per vessel (gal/day) | | | Annual generation rate per class (gal/year) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | In Port | Underway (0-12 nm) | Underway (12+ nm) | In Port | Underway (0-12 nm) | Underway (12+ nm) |
| AFDL 1 | 1 | 305 | 60 | 0 | 2.5E+01 | 1.0E+02 | 0 | 7.6E+03 | 6.0E+03 | N/A |
| AFDL 47 | 1 | 305 | 60 | 0 | 1.5E+02 | 6.0E+02 | 0 | 4.6E+04 | 3.6E+04 | N/A |
| AFDM 3 | 2 | 305 | 60 | 0 | 2.0E+02 | 8.0E+02 | 0 | 1.2E+05 | 9.6E+04 | N/A |
| AGOR 14 | 2 | 145 | 20 | 200 | 2.3E+02 | 9.0E+02 | 9.0E+02 | 6.7E+04 | 3.6E+04 | 3.6E+05 |
| AGOR 23 | 3 | 145 | 20 | 200 | 1.5E+02 | 6.0E+02 | 6.0E+02 | 6.5E+04 | 3.6E+04 | 3.6E+05 |
| AGOR 26 | 1 | 145 | 20 | 200 | 1.5E+02 | 6.0E+02 | 6.0E+02 | 2.2E+04 | 1.2E+04 | 1.2E+05 |
| ARS 50 | 4 | 156 | 60 | 149 | 1.0E+02 | 4.0E+02 | 4.0E+02 | 6.2E+04 | 9.6E+04 | 2.4E+05 |
| IX 517 | 1 | 335 | 30 | 0 | 7.5E+01 | 3.0E+02 | 0 | 2.5E+04 | 9.0E+03 | N/A |
| IX 524 | 1 | 305 | 60 | 0 | 7.5E+01 | 3.0E+02 | 0 | 2.3E+04 | 1.8E+04 | N/A |
| IX 529 | 1 | 335 | 30 | 0 | 2.5E+01 | 1.0E+02 | 0 | 8.4E+03 | 3.0E+03 | N/A |
| LCU 2000 | 27 | 265 | 30 | 40 | 5.0E+01 | 2.0E+02 | 2.0E+02 | 3.6E+05 | 1.6E+05 | 2.2E+05 |
| LST 1179 | 1 | 178 | 4 | 183 | 6.0E+02 | 2.4E+03 | 2.4E+03 | 1.1E+05 | 9.6E+03 | 4.4E+05 |
| LSV | 9 | 120 | 30 | 185 | 1.0E+02 | 4.0E+02 | 4.0E+02 | 1.1E+05 | 1.1E+05 | 6.7E+05 |
| LT 128 | 5 | 215 | 60 | 60 | 5.0E+01 | 2.0E+02 | 2.0E+02 | 5.4E+04 | 6.0E+04 | 6.0E+04 |
| MCM 1 | 12 | 233 | 9 | 123 | 1.0E+02 | 4.0E+02 | 4.0E+02 | 2.8E+05 | 4.3E+04 | 5.9E+05 |
| MHC 51 | 12 | 242 | 123 | 0 | 5.0E+01 | 2.0E+02 | 0 | 1.5E+05 | 3.0E+05 | N/A |
| NS 143 | 1 | 305 | 60 | 0 | 2.5E+01 | 1.0E+02 | 0 | 7.6E+03 | 6.0E+03 | N/A |
| NS 180 | 1 | 305 | 60 | 0 | 1.0E+02 | 4.0E+02 | 0 | 3.1E+04 | 2.4E+04 | N/A |
| T-AG 195 | 1 | 145 | 20 | 200 | 3.0E+02 | 1.2E+03 | 1.2E+03 | 4.4E+04 | 2.4E+04 | 2.4E+05 |
| T-AGOS 1 | 6 | 145 | 20 | 200 | 1.5E+02 | 6.0E+02 | 6.0E+02 | 1.3E+05 | 7.2E+04 | 7.2E+05 |
| T-AGOS 19 | 4 | 145 | 20 | 200 | 2.0E+02 | 8.0E+02 | 8.0E+02 | 1.2E+05 | 6.4E+04 | 6.4E+05 |
| T-AGOS 23 | 1 | 145 | 20 | 200 | 2.0E+02 | 8.0E+02 | 8.0E+02 | 2.9E+04 | 1.6E+04 | 1.6E+05 |
| T-AGS 51 | 2 | 245 | 20 | 100 | 5.0E+01 | 2.0E+02 | 2.0E+02 | 2.5E+04 | 8.0E+03 | 4.0E+04 |
| T-AGS 60 | 6 | 245 | 20 | 100 | 2.5E+02 | 1.0E+03 | 1.0E+03 | 3.7E+05 | 1.2E+05 | 6.0E+05 |
| T-ATF 166 | 6 | 245 | 20 | 100 | 1.5E+02 | 6.0E+02 | 6.0E+02 | 2.2E+05 | 7.2E+04 | 3.6E+05 |
| UB 192 | 2 | 305 | 60 | 0 | 1.3E+02 | 5.0E+02 | 0 | 7.9E+04 | 6.0E+04 | N/A |
| WB 180 | 1 | 215 | 150 | 0 | 5.0E+01 | 2.0E+02 | 0 | 1.1E+04 | 3.0E+04 | N/A |
| WIX 180 | 1 | 135 | 100 | 116 | 2.5E+01 | 1.0E+02 | 1.0E+02 | 3.4E+03 | 1.0E+04 | 1.2E+04 |
| WIX 295 | 1 | 196 | 36 | 105 | 5.0E+01 | 2.0E+02 | 2.0E+02 | 9.8E+03 | 7.2E+03 | 2.1E+04 |
| WLB 180 | 5 | 135 | 100 | 116 | 2.5E+01 | 1.0E+02 | 1.0E+02 | 1.7E+04 | 5.0E+04 | 5.8E+04 |
| WLB 225 | 14 | 135 | 100 | 116 | 7.5E+01 | 3.0E+02 | 3.0E+02 | 1.4E+05 | 4.2E+05 | 4.9E+05 |
| WLM 175 | 13 | 123 | 200 | 36 | 2.5E+00 | 1.0E+01 | 1.0E+01 | 4.0E+03 | 2.6E+04 | 4.7E+03 |
| WMEC 213 | 1 | 176 | 12 | 162 | 1.3E+02 | 5.0E+02 | 5.0E+02 | 2.3E+04 | 6.0E+03 | 8.1E+04 |
| WMEC 230 | 1 | 176 | 12 | 162 | 7.5E+01 | 3.0E+02 | 3.0E+02 | 1.3E+04 | 3.6E+03 | 4.9E+04 |
| WMEC 270 | 13 | 176 | 12 | 162 | 2.3E+02 | 9.0E+02 | 9.0E+02 | 5.3E+05 | 1.4E+05 | 1.9E+06 |
| WTGB 140 | 4 | 200 | 150 | 0 | 2.5E+01 | 1.0E+02 | 1.0E+02 | 2.0E+04 | 6.0E+04 | N/A |
| YTT 9 | 2 | 305 | 60 | 0 | 2.5E+01 | 1.0E+02 | 1.0E+02 | 1.5E+04 | 1.2E+04 | N/A |
| Total | 169 | - | - | - | 4.4E+03 | 1.8E+04 | 1.4E+04 | 3.4E+06 | 2.5E+06 | 8.4E+06 |

[1] Vessels stationed in foreign ports are not included in the annual generation value.
[2] Total number of days for in port, Underway 0-12nm, and Underway 12+nm may not add up to 365 days due to some vessel classes being removed from the water to facilitate cleaning, maintenance, and/or repair.

Table 9-5 illustrates those vessels stationed and operating in freshwater.

**Table 9-5. MCM 1 Generation Volumes for Vessels Operating in Freshwater**

| Class | Number of Vessels | Days in Port[1] | Days Underway | Daily generation rate per vessel (gal/day) | | Annual generation rate per class (million gal/year) | |
|---|---|---|---|---|---|---|---|
| | | | | In Port | Underway | In Port | Underway |
| WAGB 290 | 1 | 140 | 200 | 4.5E+02 | 1.8E+03 | 6.3E+04 | 3.6E+05 |
| WLB 180 | 3 | 135 | 100 | 2.5E+01 | 1.0E+02 | 1.0E+04 | 3.0E+04 |
| WLB 225 | 2 | 135 | 216 | 7.5E+01 | 3.0E+02 | 2.0E+04 | 1.3E+05 |
| WLM 175 | 1 | 123 | 236 | 2.5E+00 | 1.0E+01 | 3.1E+02 | 2.4E+03 |
| WTGB 140 | 5 | 200 | 150 | 2.5E+01 | 1.0E+02 | 2.5E+04 | 7.5E+04 |
| Total | 12 | - | - | 5.8E+02 | 2.3E+03 | 1.2E+05 | 6.0E+05 |

[1] Total number of days for in port, Underway 0-12nm, and Underway 12+nm may not add up to 365 days due to some vessel classes being removed from the water to facilitate cleaning, maintenance, and/or repair.

## 9.2 PRIMARY TREATMENT

Gravity coalescer represents the currently installed primary treatment MPCD onboard MCM 1 Class vessels. Most ships of the MCM 1 Class currently have one 3-gpm system with a single discharge location. As a result, subsequent analyses are based on a single 3-gpm system processing the entire volume of bilgewater. Primary treatment creates two waste streams: the aqueous fraction, which is discharged overboard, and the oil fraction, which is directed to the onboard waste oil holding tank. The characterization of the aqueous fraction is described below. The oil fraction is subject to collection, holding and transfer (CHT), treatment at a properly permitted facility, and applicable Federal, State, and local disposal regulations.

### 9.2.1 Characterization Data

Characterization data are comprised of physical parameters, chemical data, field data, and descriptive information. Each of these parameters is discussed below. See Section 9.1.1 for identification of possible bilgewater sources.

#### *9.2.1.1 Physical Parameters*

The physical parameters used for hydrodynamic modeling, as detailed in Section 9.1.1.1, are not affected by the addition of a primary MPCD. Table 9-6 summarizes the parameters used for modeling purposes.

**Table 9-6. Discharge Characteristics for MCM 1 Primary Treatment**

| Modeling Parameters | Values |
|---|---|
| Option Group | Primary Treatment |
| Vertical (feet) | +2 |
| Transverse (feet) | -22 |
| Length (feet) | 210 |
| Diameter (inches) | 1.5 |
| Temperature (°C) | 25 |
| Salinity (ppt) | 8.0 |
| Flow (gpm) | 3 |
| Velocity (ft/sec) | 0.55 |
| Duration of Release Event (hr) | 2.05 |
| Time Between Release Events (hr) | 86.45 |

Vertical – Approximate distance from waterline to discharge port (+, above, -, below)
Transverse – Distance from centerline to discharge port (+, port, -, starboard)
Length – Approximate distance from forward perpendicular to discharge port
Diameter – Diameter of discharge port
ppt – parts per thousand
gpm – gallons per minute
ft/sec – feet per second
hr – hour
°C – Degree Celsius

The formulas used to determine some of the values in the physical parameters section are presented in Appendix A.

### *9.2.1.2 Constituent Data, Classical Data, and Other Descriptors*

#### *Chemical Data*

During Phase II of UNDS, sampling was conducted on two LSD 41 Class vessels, USS RUSHMORE (LSD 47) and USS OAK HILL (LSD 51), and serves as the primary source of chemical data for this vessel group. The samples from this ship were taken prior to and following the gravity coalescer. Based on the samples collected following the gravity coalescer, a final concentration was determined for each constituent. Some analytical data were excluded, as documented in the Sampling Episode Report (SER), based upon SCC review of the data. See Appendix G for constituent values.

#### *Field Information*

Field information refers to data obtained at the time of sample collection. Due to similarities in machinery, propulsion systems, and ancillary equipment, the LSD 41 vessel group discharge information is used to represent the MCM 1 vessel group. Consequently, the LSD 41 field data presented in Table 9-7 are surrogate values for the MCM 1 vessel group.

**Table 9-7. Surrogate Field Testing for MCM 1 Primary Treatment (Based on LSD 41 Baseline Sampling Data)**

| Field Parameter | Values |
|---|---|
| pH | 6.9 |
| Temperature | 16.1 °C |
| Salinity | 7.4 ppt |
| Specific Conductance | 13,000 µS/cm |
| Free Chlorine | 0.04 mg/L |
| Total Chlorine | 0.04 mg/L |

### *Descriptive Information*

Descriptive information refers to data collected to facilitate the environmental effects analysis. Due to similarities in machinery, propulsion systems, and ancillary equipment, the LSD 41 vessel group discharge information is used to represent the MCM 1 vessel group. Consequently, the LSD 41 vessel group data presented in Table 9-8 are surrogate data for characterization of the MCM 1 vessel group. For the parameters where the results were based on observation, the range of descriptive records provide the determinations. Specifically, color and odor determinations were made using these samples. For the parameters where the results were based on field tests, an average was used as the parameter value, except for the total dissolved gases parameter. For this parameter, the lowest DO value was reported in the profile report and used in the environmental effects analysis, because low DO is of greater environmental concern.

**Table 9-8. Surrogate Descriptive Discharge Profile for MCM 1 Primary Treatment (Based on LSD 41 Baseline Sampling Data)**

| Narrative Parameter | Field Observations |
|---|---|
| Color | Variable: ½ clear and ½ yellow |
| Floating Materials | None observed in most samples collected |
| Foam | None observed in samples collected |
| Odor | Oil/Fuel smell |
| Scum | None observed in samples collected |
| Settleable Materials | None observed in samples collected |
| Total Dissolved Gases | DO 0.40 mg/L, no other gases were measured |
| Turbidity/Colloidal Matter | 33 NTU/No |

### *9.2.1.3 Discharge Generation Rates for Mass Loading*

The use of a primary treatment MPCD does not affect the generation rate of bilgewater; therefore, the baseline generation and annual volume data are used for the annual discharge volume for this MPCD treatment system. It is assumed that the volume change due to the removal of oil by the treatment device is negligible. See Table 9-4 and Table 9-5, Section 9.1.1.3, for the baseline generation volumes for vessels operating and stationed in freshwater and saltwater ports.

## 9.3 PRIMARY TREATMENT PLUS FILTER MEDIA

This MPCD option involves treatment with a primary treatment MPCD followed by a secondary treatment through filter media. Primary treatment plus filter media creates two waste streams: the aqueous fraction, which is discharged overboard, and the oil fraction, which is directed to the onboard waste oil holding tank. After initial treatment by the OWS, the aqueous waste stream is either re-directed back to the OWHT for reprocessing or sent to the polisher (i.e., filter media) system. This is controlled by monitoring the waste stream oil concentration with an oil content monitor (OCM). For concentrations greater than 200 ppm, the waste stream is returned to the OWHT for re-circulation through the OWS, whereas for oil concentrations less than 200 ppm, the waste stream is sent on to the filter media system (Navy, 2000c). The filter media discharge is also monitored. Effluent with oil concentration less than 15 ppm, is released overboard while wastewater with a greater than 15 ppm, it is returned to the OWHT for additional processing (Navy, 2000c). The oil fraction is subject to CHT treatment at a properly-permitted facility and applicable Federal, State, and local disposal regulations.

The characterization of the aqueous fraction is described below.

### 9.3.1 Characterization Data

Characterization data are comprised of physical parameters, chemical data, field data, and descriptive information. Each of these parameters is discussed below. See Section 9.1.1 for identification of possible bilgewater sources.

#### *9.3.1.1 Physical Parameters*

The physical parameters used for hydrodynamic modeling purposes, as detailed in Section 9.1.1.1, are not affected by the addition of primary and secondary MPCDs. Table 9-9 summarizes the parameters identified for modeling purposes.

**Table 9-9. Discharge Characteristics for MCM 1 Primary Treatment Plus Filter Media**

| Modeling Parameters | Values |
|---|---|
| Option Group | Primary Treatment plus Filter Media |
| Vertical (feet) | +2 |
| Transverse (feet) | -22 |
| Length (feet) | 210 |
| Diameter (inches) | 1.5 |
| Temperature (°C) | 25 |
| Salinity (ppt) | 8.0 |
| Flow (gpm) | 3 |
| Velocity (ft/sec) | 0.55 |
| Duration of Release Event (hr) | 2.05 |
| Time Between Release Events (hr) | 86.45 |

Vertical – Approximate distance from waterline to discharge port (+, above, -, below)
Transverse – Distance from centerline to discharge port (+, port, -, starboard)
Length – Approximate distance from forward perpendicular to discharge port
Diameter – Diameter of discharge port
ppt – parts per thousand
gpm – gallons per minute
ft/sec – feet per second
hr – hour
°C – Degree Celsius

The formulas used to determine some of the values in the physical parameters section are presented in Appendix A.

#### *9.3.1.2 Constituent Data, Classical Data, and Other Descriptors*

***Chemical Data***

Using bilgewater effluent data, the Naval Surface Warfare Center Carderock Division (NSWCCD) evaluated the treatment capabilities for filter media. The filter media MPCD is comprised of an oleophilic blend of granular polymer and carbon media. Although the polymer was designed to remove oil by entrainment and sorption, the carbon media will also reduce the concentrations of semi-volatile organic constituents, especially polynuclear aromatic hydrocarbons (PAHs) (Putnam and Singerman, 2001). Table 9-10 contains the treatment capabilities detailed within the NSWCCD report for filter media and the necessary calculations for the primary treatment MPCD constituents.

**Table 9-10. Treatment Capabilities of Filter Media (Putnam and Singerman, 2001)**

| Analyte Class | Empirical Formulas for Constituent Concentrations |
|---|---|
| Classical | Ammonia as Nitrogen = $C_i$<br>Nitrite/Nitrate = $0.6C_i$<br>Oil & Grease (HEM) = $0.3C_i$<br>TPH (SGT-HEM) = $0.3C_i$<br>Total Sulfide = $0.2C_i$<br>TSS = $0.43C_i$ |
| Total Metals | Copper = $0.5M_t$<br>Iron = $0.4M_t$<br>Nickel = $0.75M_t$<br>Zinc = $0.6M_t$<br>All others = $M_t$ |
| Semi-volatile Organics | = $0.4C_i$ |
| Volatile Organics | Chlorobenzene = $0.20C_i$<br>M+p-Xylene = $0.20C_i$ |

$C_i$ is the concentration of the constituent in the input stream.
$M_t$ is the total concentration of the metal in the input stream.

Applying these treatment capabilities of filter media to the final results for the constituents of the OWS effluent produces the constituent concentrations expected by incorporating filter media (Table 9-11). See Appendix G for complete list of constituent values.

**Table 9-11. Surrogate Constituent Concentrations for MCM 1 Primary Treatment plus Filter Media (Based on LSD 41 Baseline Sampling Data)**

| Contaminant | CAS Number | Primary Treatment | Data Qualifier | Estimated Concentration Primary Treatment plus Filter Media | Data Qualifier |
|---|---|---|---|---|---|
| **Classical (mg/L)** | | | | | |
| Alkalinity | T005 | 2.1E+02 | | 2.1E+02 | |
| Ammonia as Nitrogen | 7664417 | 1.6E+00 | | 1.6E+00 | |
| Biochemical Oxygen Demand (BOD) | C003 | 2.9E+01 | | 2.9E+01 | |
| Chemical Oxygen Demand (COD) | C004 | 3.8E+02 | | 3.8E+02 | |
| Chloride | 16887006 | 4.4E+03 | | 4.4E+03 | |
| Nitrate/Nitrite | C005 | 3.2E+00 | | 1.9E+00 | |
| Oil and Grease (as HEM) | C036 | 2.2E+01 | | 6.5E+00 | |
| SGT-HEM | C037 | 1.0E+01 | | 5.0E+00 | U |
| Sulfate | 14808798 | 4.5E+02 | | 4.5E+02 | |
| Total Dissolved Solids | C010 | 7.1E+03 | | 7.1E+03 | |
| Total Kjeldahl Nitrogen (TKN) | C021 | 3.5E+00 | | 3.5E+00 | |
| Total Organic Carbon | C012 | 2.7E+01 | | 2.7E+01 | |
| Total Phosphorous | 14265442 | 1.8E-01 | | 1.8E-01 | |
| Total Sulfide | 18496258 | 2.6E+00 | | 1.0E+00 | U |
| Total Suspended Solids | C009 | 2.3E+01 | | 1.0E+01 | |
| Volatile Residue | C030 | 1.3E+03 | | 1.3E+03 | |

| Contaminant | CAS Number | Primary Treatment | Data Qualifier | Estimated Concentration Primary Treatment plus Filter Media | Data Qualifier |
|---|---|---|---|---|---|
| **Semivolatile Organics (ug/L)** | | | | | |
| 2,4-Dimethylphenol | 105679 | 2.9E+01 | | 1.0E+01 | U |
| 2-Chloronapthalene | 91587 | 1.0E+01 | U | 1.0E+01 | U |
| 2-Methylnapthalene | 91576 | 1.4E+01 | | 1.0E+01 | U |
| Acenapthene | 83329 | 1.0E+01 | U | 1.0E+01 | U |
| Acetophenone | 98862 | 1.3E+01 | | 1.0E+01 | U |
| Benzoic Acid | 65850 | 5.8E+01 | | 5.0E+01 | U |
| Benzyl Alcohol | 100516 | 1.0E+01 | | 1.0E+01 | U |
| Biphenyl | 92524 | 1.0E+01 | U | 1.0E+00 | U |
| Bis-(2-ethylhexyl) Phthalate | 117817 | 1.0E+01 | U | 1.0E+01 | U |
| Dibenzofuran | 132649 | 1.0E+01 | U | 1.0E+01 | U |
| Dimethyl Phthalate | 131113 | 1.2E+01 | | 1.0E+01 | U |
| Fluorene | 86737 | 1.0E+01 | U | 1.0E+01 | U |
| Naphthalene | 91203 | 1.4E+01 | | 1.0E+01 | U |
| N-Decane | 124185 | 1.2E+01 | | 1.0E+01 | U |
| N-Docosane | 629970 | 1.2E+01 | | 1.0E+01 | U |
| N-Dodecane | 112403 | 3.3E+01 | | 1.3E+01 | |
| N-Eicosane | 112958 | 2.8E+01 | | 1.1E+01 | |
| N-Hexadecane | 544763 | 4.1E+01 | | 1.6E+01 | |
| N-Octadecane | 593453 | 2.8E+01 | | 1.1E+01 | |
| N-Tetracosane | 646311 | 1.2E+01 | | 1.0E+01 | U |
| N-Tetradecane | 629594 | 2.0E+01 | | 1.0E+01 | U |
| O-Cresol | 95487 | 1.1E+01 | | 1.0E+01 | U |
| Phenanthrene | 85018 | 1.1E+01 | | 1.0E+01 | U |
| Phenol | 108952 | 1.3E+01 | | 1.0E+01 | U |
| **Volatile Organics (ug/L)** | | | | | |
| Chlorobenzene | 108907 | 1.0E+01 | U | 1.0E+01 | U |
| m+p-Xylene | 179601231 | 5.1E+01 | | 1.0E+01 | |
| 2-Butanone | 78933 | 5.1E+01 | | 5.1E+01 | |
| 2-Propanone | 67641 | 6.0E+01 | | 6.0E+01 | |
| 4-Methyl-2-pentanone | 108101 | 7.6E+01 | | 7.6E+01 | |
| Benzene | 71432 | 2.5E+01 | | 2.5E+01 | |
| Carbon Disulfide | 75150 | 1.0E+01 | | 1.0E+01 | |
| Ethylbenzene | 100414 | 1.9E+01 | | 1.9E+01 | |
| o-Xylene | 95476 | 4.0E+01 | | 4.0E+01 | |
| Toluene | 108883 | 5.1E+01 | | 5.1E+01 | |
| **Total Metals (ug/L)** | | | | | |
| Aluminum | 7429905 | 5.1E+01 | | 5.1E+01 | |
| Antimony | 7440360 | 6.0E+00 | | 6.0E+00 | |
| Arsenic | 7440382 | 1.3E+00 | | 1.3E+00 | |

| Contaminant | CAS Number | Primary Treatment | Data Qualifier | Estimated Concentration Primary Treatment plus Filter Media | Data Qualifier |
|---|---|---|---|---|---|
| Barium | 7440393 | 3.6E+01 | | 3.6E+01 | |
| Boron | 7440428 | 1.7E+03 | | 1.7E+03 | |
| Cadmium | 7440439 | 3.0E+00 | U | 3.0E+00 | U |
| Calcium | 7440702 | 1.2E+05 | | 1.2E+05 | |
| Chromium | 7440473 | 4.3E+00 | U | 4.3E+00 | |
| Copper | 7440508 | 1.9E+02 | U | 9.4E+01 | |
| Iron | 7439896 | 2.7E+02 | | 1.1E+02 | |
| Lead | 7439921 | 9.1E+00 | | 9.1E+00 | |
| Magnesium | 7439954 | 2.5E+05 | | 2.5E+05 | |
| Manganese | 7439965 | 1.1E+02 | | 1.1E+02 | |
| Molybdenum | 7439987 | 4.5E+00 | | 4.5E+00 | |
| Nickel | 7440020 | 1.2E+02 | | 8.9E+01 | |
| Selenium | 7782492 | 6.9E+00 | | 6.9E+00 | |
| Silver | 7440224 | 6.2E+00 | U | 6.2E+00 | U |
| Sodium | 7440235 | 2.3E+06 | | 2.3E+06 | |
| Thallium | 7440280 | 1.5E+01 | U | 1.5E+01 | U |
| Tin | 7440315 | 9.2E+00 | | 9.2E+00 | |
| Zinc | 7440666 | 4.8E+02 | | 2.9E+02 | |

U – Not detected in waste stream

For additional information on the capabilities of filter media, NSWCCD conducted field testing of two onboard filter media systems. The systems were on USS GONZALES (DDG 66) and USS ROSS (DDG 71). The testing was undertaken to evaluate the performance of filter media and its subsequent ability to improve the quality of the water discharged from the OWS.

Testing showed that although the filter media functioned to remove oil, it was not consistently effective at achieving oil concentrations of less than 15 ppm. In the more favorable of two cases, the oil concentration was less than 15 ppm in only 32 percent of the effluent samples taken. For the second test the filter media system was even less effective at obtaining concentrations below 15 ppm. Both tests demonstrated that the percentage of oil removed by the filter media system was closely related to the OWS influent oil concentration (specifically, the higher the levels of influent particulate, the less efficient the removal process) (Navy, 2001c).

Although the finding did not support filter media achieving the less than 15 ppm oil concentration sought, it was concluded that the filter media system did reduce the discharged oil concentrations below those of the gravity coalescer alone.

### *Field Information*

Field information refers to data obtained at the time of sample collection. Due to similarities in machinery, propulsion systems, and ancillary equipment, the LSD 41 vessel group discharge information is used to represent the MCM 1 vessel group. Consequently, the LSD 41 field data presented in Table 9-12 are surrogate values for the MCM 1 vessel group.

**Table 9-12. Surrogate Field Testing for MCM 1 Primary Treatment plus Filter Media (Based on LSD 41 Baseline Sampling Data)**

| Field Parameter | Values |
|---|---|
| pH | 6.9 |
| Temperature | 16.1 °C |
| Salinity | 7.4 ppt |
| Specific Conductance | 13,000 µS/cm |
| Free Chlorine | 0.04 mg/L |
| Total Chlorine | 0.04 mg/L |

### *Descriptive Information*

Descriptive information refers to data collected to facilitate the environmental effects analysis. Due to similarities in machinery, propulsion systems, and ancillary equipment, the LSD 41 vessel group discharge information is used to represent the MCM 1 vessel group. For the parameters where the results were based on observation, the range of descriptive records provide the determinations. Specifically, color and odor determinations were made using these samples. For the parameters where the results were based on field tests, an average was used as the parameter value, except for the total dissolved gases parameter. For this parameter, the lowest DO value was reported in the profile report and used in the environmental effects analysis, because low DO is of greater environmental concern. The filter media MPCD was not sampled for the LSD 47 class; however, based on a review of the filter media results for the DDG 51 vessel groups, the change in color from primary treatment to primary treatment plus filter media went from black to dark gray. A similar degree of change was assumed to occur for the LSD 41 vessel group, when a filter media MPCD is used. Consequently, while primary treatment yields a yellow colored effluent, further treatment with a filter media MPCD is expected to yield a light yellow colored effluent. Similar extrapolations were made for floating material, odor, settleable materials, and turbidity/colloidal matter.

### *9.3.1.3 Discharge Generation Rates for Mass Loading*

The use of a primary and secondary MPCD does not affect the generation rate of bilgewater; therefore, the baseline generation and annual volume data are used for the annual discharge volume for this MPCD treatment system. It is assumed that the volume change due to the removal of oil by other treatment devices is negligible. See Table 8-4 and 8-5, Section 9.1.1.3, for the baseline generation volumes.

## 9.4 PRIMARY TREATMENT PLUS MEMBRANE FILTRATION

This MPCD option involves the waste stream being processed by a primary treatment MPCD followed by the secondary treatment of membrane filtration. Primary treatment plus membrane filtration creates two waste streams: the aqueous fraction, which is discharged overboard, and the oil fraction, which is directed to the onboard waste oil holding tank. The characterization of the aqueous fraction is described below. The oil fraction is subject to CHT, treatment at a properly permitted facility, and applicable Federal, State, and local disposal regulations.

### 9.4.1 Characterization Data

Characterization data are comprised of physical parameters, chemical data, field data, and descriptive information. Each of these parameters are discussed below. See Section 9.1.1 for identification of possible bilgewater sources.

#### *9.4.1.1 Physical Parameters*

The physical parameters used for hydrodynamic modeling purposes, as detailed in Section 9.1.1.1, are not affected by the addition of primary and secondary MPCDs. Table 9-143 summarizes the parameters identified for modeling purposes.

**Table 9-13. Discharge Characteristics for MCM 1 Primary Treatment plus Membrane Filtration**

| Modeling Parameters | Values |
|---|---|
| Option Group | Primary treatment plus membrane filtration |
| Vertical (feet) | +2 |
| Transverse (feet) | -22 |
| Length (feet) | 210 |
| Diameter (inches) | 1.5 |
| Temperature (°C) | 25 |
| Salinity (ppt) | 8.0 |
| Flow (gpm) | 3 |
| Velocity (ft/sec) | 0.55 |
| Duration of Release Event (hr) | 2.05 |
| Time Between Release Events (hr) | 86.45 |

Vertical – Approximate distance from waterline to discharge port (+, above, -, below)
Transverse – Distance from centerline to discharge port (+, port, -, starboard)
Length – Approximate distance from forward perpendicular to discharge port
Diameter – Diameter of discharge port
ppt – parts per thousand
gpm – gallons per minute
ft/sec – feet per second
hr – hour
°C – Degree Celsius

The formulas used to determine some of the values in the physical parameters section are presented in Appendix A.

#### *9.4.1.2 Constituent Data, Classical Data, and Other Descriptors*

***Chemical Data***

Samples from the ships were taken at three points: prior to primary treatment, following primary treatment, and then following the membrane filtration treatment device. A geometric mean concentration for samples following the secondary treatment was determined for each constituent. Samples that were excluded by the SCC based on their review of the analytical data as documented in the Sampling Episode Reports were not included in the reported calculations. See Appendix G for a list of constituent values.

### *Field Information*

Field information refers to data obtained at the time of sample collection. Due to similarities in machinery, propulsion systems, and ancillary equipment, the LSD 41 vessel group discharge information is used to represent the MCM 1 vessel group. Consequently, the LSD 41 field data presented in Table 9-14 are surrogate values for the MCM 1 vessel group.

**Table 9-14. Surrogate Field Testing for MCM 1 Primary Treatment plus Membrane Filtration (Based on LSD 41 Baseline Sampling Data)**

| Field Parameter | Values |
|---|---|
| pH | 7 |
| Temperature | 25.6 ºC |
| Salinity | 6.5 ppt |
| Specific Conductance | 11,000 µS/cm |
| Free Chlorine | <0.04 mg/L |
| Total Chlorine | <0.04 mg/L |

### *Descriptive Information*

Descriptive information refers to data collected to facilitate the environmental effects analysis. Due to similarities in machinery, propulsion systems, and ancillary equipment, the LSD 41 vessel group discharge information is used to represent the MCM 1 vessel group. Consequently, the LSD 41 vessel group data presented in Table 9-15 are surrogate data for characterization of the MCM 1 vessel group. For the parameters where the results were based on observation, the range of descriptive records provide the determinations. Specifically, color and odor determinations were made using these samples. For the parameters where the results were based on field tests, an average was used as the parameter value, except for the total dissolved gases parameter. For this parameter, the lowest DO value was reported in the profile report and used in the environmental effects analysis, because low DO is of greater environmental concern.

**Table 9-15. Surrogate Descriptive Discharge Profile for MCM 1 Primary Treatment plus Membrane Filtration (Based on LSD 41 Baseline Sampling Data)**

| Narrative Parameter | Field Observations |
|---|---|
| Color | Yellow, 69 Color Units |
| Foam | None observed in samples collected |
| Floating Materials | None observed in samples collected |
| Odor | Fuel/ Oil Smell |
| Scum | None observed in samples collected |
| Settleable Materials | None observed in samples collected |
| Total Dissolved Gases | DO 1.23 mg/L, no other gases were measured |
| Turbidity/Colloidal Matter | 9.4 NTU/No |

#### *9.4.1.3 Discharge Generation Rates for Mass Loading*

The use of primary and secondary MPCDs does not affect the generation rate of bilgewater; therefore the baseline generation and annual volume data are used for the annual discharge volume for this MPCD treatment system. It is assumed that the volume change due to removal of oil by treatment device is negligible. See Table 9-4 and Table 9-5, Section 9.1.1.3 for the baseline generation volumes.

## 9.5 COLLECTION, HOLDING, AND TRANSFER WITHIN 12NM

CHT is the onboard collection, containment, and subsequent transfer of bilgewater to shore facilities or ship waste offload barges (SWOBs). CHT does not involve any treatment of raw bilgewater on board the generating vessel. CHT may require the installation of some shipboard equipment, such as piping or tanks, to provide additional holding capacity. This MPCD option results in no (zero) liquid discharge to surrounding waters within 12 nm.

### 9.5.1 Characterization Data

Characterization data are comprised of physical parameters, chemical data, field data, and descriptive information. Each of these parameters is discussed below. See Section 9.1.1 for identification of bilgewater sources. However, because this MPCD option results in no (zero) liquid discharge to surrounding waters there is no characterization data to address.

#### *9.5.1.1 Physical Parameters*

This MPCD option results in no (zero) direct liquid discharge to surrounding waters within 12 nm; therefore, there are no discharge characteristics to consider.

#### *9.5.1.2 Constituent Data, Classical Data, and Other Descriptors*

***Chemical Data***

Because a waste stream is not directly discharged to surrounding waters within 12 nm for this MPCD option, there are no constituents to consider.

***Field Information***

Because a waste stream is not directly discharged to surrounding waters within 12 nm for this MPCD option, there are no field data to consider.

***Descriptive Information***

Because a waste stream is not directly discharged to surrounding waters within 12 nm for this MPCD option, there is no descriptive information data to consider.

#### *9.5.1.3 Discharge Generation Rates for Mass Loading*

CHT results in no direct liquid discharge within 12 nm. Therefore, the annual discharge volume is zero.

## 9.6 UNCERTAINTY AND DATA QUALITY FOR MCM 1 DISCHARGE

The sources and levels of uncertainty in bilgewater characterization data vary by discharge parameter. This subsection describes the uncertainty associated with physical parameters; constituent data, classical data, and other descriptors; and discharge generation rates.

### 9.6.1 Physical Parameters Uncertainty and Data Quality for MCM 1 Discharge

***Schematic Data***

The information provided for the physical parameters of MCM 1 vessel group baseline discharge is based on process knowledge and the vessel specifications of the representative vessel. Certain physical parameter values used in this report, including representative vessel length, discharge port diameter, and distance from centerline to discharge port (transverse), are taken directly from vessel schematics. These parametric values do not vary among vessels in the class. Certain other parameters vary with load conditions. These condition-specific parameters include: approximate distance from waterline to discharge port (vertical), and discharge method. The discharge was assumed to occur under full load conditions to facilitate a comparison of baseline and MPCD option performance. This assumption is supported by Armed Forces expert knowledge of ship status, which indicated that when vessels are pierside they typically are loaded for deployment.

***Modeling Data***

One use of the discharge characterization information is to provide input data for modeling. Modeling is performed to determine plume dilution factors at the edge of a mixing zone. Modeling calculations involve various parameters that include discharge temperature, density (salinity), and vessel attributes related to bilgewater discharge, such as the distance from the discharge port to the waterline. The bilgewater temperature was assumed to be equal to ambient water temperature for modeling purposes. Bilgewater is stored in OWHTs in direct contact with the hull, resulting in temperature equilibration. The bilgewater data for salinity was taken from

UNDS sampling data. Uncertainty related to sampling is discussed in Section 9.6.2 and applies to the salinity data.

As stated in Section 9.1.1.11, the discharge flow rate used to characterize the discharge is based on the rated capacity of the processor as reported by the manufacturer. The duration of, and time between release events are closely related and are dependent on the volume of the OWHT. The volume of the OWHT at processing onset determines the duration of the release event. Likewise, the time between release events is related to the capacity of the OWHT and the bilgewater generation rate. A simplifying assumption, that the release of bilgewater discharge occurs when the OWHT reaches 90 percent of capacity, was made based on knowledge derived from equipment experts.

### 9.6.2 Constituent Data, Classical Data, and Other Descriptors Uncertainty and Data Quality for MCM 1 Discharge

Uncertainty associated with the MCM 1 vessel group is due to the lack of sampling data from the representative vessel or any other vessel within the vessel group. Sample data used to characterize this vessel group were taken from UNDS Phase II sampling results for the LSD 41. However, because the engine types of the MCM 1 and LSD 41 are similar, it is reasonable for the LSD 41 to represent the MCM vessel group. Additionally, because the LSD 41 is a larger vessel, it releases and processes a greater quantity of bilgewater, so the use of this data for the MCM 1 provides a conservative illustration of the discharge. Sampling was conducted aboard the LSD 47 and LSD 51 according to the SAP (Navy, 2000f and 2001e). Deviations in sampling practices, analytic testing, laboratory equipment, processing equipment, and specimen handling exist and may affect the results. For more information on the sampling plan, see the LSD 47 and LSD 51 SAPs.

During the sampling episode, deviations from the sampling plan were noted in the SER.

- Sampling deviations recorded on USS RUSHMORE (LSD 47) were due to the inability to sample while the ship was underway. All samples were collected while the vessel was in port. Consequently, the ceramic membrane permeate was directed to the waste oil tank (WOT) instead of being discharged overboard.

- Deviations from the SAP on USS OAK HILL (LSD 51) included the possible inadvertent discharge of oily waste overboard due to a malfunctioning oil content monitor.

The SER also details issues identified during the sample analysis, including the SCC's review of the analytical data. The SCC Data Review Narratives note the quality of the sample analysis data. The reports also contain further details regarding any additional data qualifiers for specific constituents for the samples. A complete description of how qualified data were used in the UNDS program can be found in Section 9.1.1.2.

### 9.6.3 Discharge Generation Uncertainty and Data Quality for MCM 1 Discharge

Bilgewater generation rates for the MCM 1 vessel group used in this report to characterize the discharge are estimated based on process knowledge and previously reported values. The

UNDS Phase I Surface Vessel Bilgewater/OWS Nature of Discharge Report (NOD) estimates that the average in-port generation rate for MCM Class vessels is approximately 2,000 gal/day (EPA and DoD, 1999). However based on actual performance data, the generation rate is typically 100 gal/day in-port and 400 gal/day underway (Navy, 1997a). Additionally, the 168 vessel classes that comprise this vessel group vary in vessel size, machinery, and displacement. Vessel engine and auxiliary machinery rooms are the main sources of bilgewater (EPA and DoD, 1999) therefore unlike other discharges, the bilgewater generation rates do not depend on crew size. As a result, having multiple vessel classes results in more variation in generation rates and adds uncertainty to these values.